

CLAIMS

What is claimed is:

- 1 1. A data processing system comprising:
2 a bus coupling components in the data processing system;
3 a display coupled to the bus;
4 external memory coupled to the bus; and
5 a processor coupled to the bus and comprising an electronic assembly
6 including at least one integrated circuit package comprising:
7 a substrate;
8 a die positioned on a surface of the substrate, the die having a
9 surface;
10 an adhesion layer of metal formed on the surface;
11 a solder-wettable layer formed on the adhesion layer;
12 a lid positioned over the die; and
13 a solderable thermally conductive element coupling the solder-
14 wettable layer and the lid.
- 1 2. The data processing system recited in claim 1 wherein the solderable
2 thermally conductive element comprises material, including one or more alloys,
3 from the group consisting of tin, bismuth, silver, indium, and lead.
- 1 3. The data processing system recited in claim 1 wherein the substrate is an
2 organic substrate and wherein the die is coupled to the substrate through a land grid
3 array.

- 1 4. A method comprising:
2 forming at least one metal layer on a surface of a die;
3 mounting the die on a substrate;
4 applying solder material to the at least one metal layer;
5 positioning a surface of a lid adjacent the solder material; and
6 melting the solder material to physically couple the lid to the die.
- 1 5. The method recited in claim 4 wherein, in applying the solder material, the
2 solder material has a relatively high thermal conductivity and a relatively low
3 melting point.
- 1 6. The method recited in claim 4 wherein, in mounting the die on the substrate,
2 the substrate comprises organic material having a relatively high thermal coefficient
3 of expansion relative to that of the die.
- 1 7. The method recited in claim 4 and further comprising forming at least one
2 metal or organic layer on the surface of the lid prior to positioning the surface of the
3 lid.
- 1 8. A method comprising:
2 forming an adhesion layer of metal on a surface of a die;
3 forming a solder-wettable layer on the adhesion layer;
4 mounting the die on a substrate;
5 applying solder material to the solder-wettable layer;
6 positioning a surface of a lid adjacent the solder material; and
7 melting the solder material to physically couple the lid to the die.

- 1 9. The method recited in claim 8 wherein, in forming the adhesion layer, the
2 adhesion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.
- 1 10. The method recited in claim 8 wherein, in forming the solder-wettable layer,
2 the solder-wettable layer comprises one of nickel and gold.
- 1 11. The method recited in claim 8 wherein, in applying the solder material, the
2 solder material has a relatively high thermal conductivity and a relatively low
3 melting point.
- 1 12. The method recited in claim 8 wherein, in mounting the die on the substrate,
2 the substrate comprises organic material having a relatively high thermal coefficient
3 of expansion relative to that of the die.
- 1 13. The method recited in claim 8 wherein, in positioning the surface of the lid,
2 the lid comprises material from the group consisting of copper and aluminum-
3 silicon-carbide.
- 1 14. The method recited in claim 8 wherein, in applying solder material, the
2 solder material comprises material, including one or more alloys, from the group
3 consisting of tin, bismuth, silver, indium, and lead.
- 1 15. The method recited in claim 8 and further comprising forming at least one
2 metal or organic layer on the surface of the lid prior to positioning the surface of the
3 lid.

1 16. The method recited in claim 15 wherein, in forming the at least one metal or
2 organic layer, the at least one metal or organic layer comprises one of nickel and
3 gold.

1 17. The method recited in claim 8 and further comprising:
2 forming a diffusion layer between the adhesion layer and the solder-wettable
3 layer.

1 18. The method recited in claim 17 wherein, in forming the diffusion layer, the
2 diffusion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.

1 19. A method comprising:
2 forming an adhesion layer of metal on a back surface of a die;
3 forming a solder-wettable layer on the adhesion layer;
4 mounting another surface of the die on a substrate; and
5 applying solder material to the solder-wettable layer.

1 20. The method recited in claim 19 wherein, in forming the adhesion layer, the
2 adhesion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.

1 21. The method recited in claim 19 wherein, in forming the solder-wettable
2 layer, the solder-wettable layer comprises one of nickel and gold.

1 22. The method recited in claim 19 wherein, in applying the solder material, the
2 solder material comprises material, including one or more alloys, from the group
3 consisting of tin, bismuth, silver, indium, and lead.

1 23. The method recited in claim 19 and further comprising:
2 forming a diffusion layer between the adhesion layer and the solder-wettable
3 layer.

1 24. The method recited in claim 23 wherein, in forming the diffusion layer, the
2 diffusion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.

1 25. A method comprising:
2 forming an adhesion layer of metal on a surface of a die; and
3 forming a solder-wettable layer on the adhesion layer.

1 26. The method recited in claim 25 wherein, in forming the adhesion layer, the
2 adhesion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.

1 27. The method recited in claim 25 wherein, in forming the solder-wettable
2 layer, the solder-wettable layer comprises one of nickel and gold.

1 28. The method recited in claim 25 and further comprising:
2 forming a diffusion layer between the adhesion layer and the solder-wettable
3 layer.

1 29. The method recited in claim 28 wherein, in forming the diffusion layer, the
2 diffusion layer comprises material, including one or more alloys, from the group
3 consisting of titanium, chromium, zirconium, nickel, vanadium, and gold.